LINEAR INEQUATIONS
SYNOPSIS - 1

INTERODUCTION OF INEQUALITIES:

1) Numerical expression joined by "is equal to' or greater than or "is lessthan'" etc, are called mathematical sentences.

2) A mathematical sentences that can be verified as either true or false but not both is called a mathematical statement.

3) A true statement containing the sign " is equal to" is called an equality.

4) A true mathematical statement containing the sign " greater than" or "less than" is called an inequality.

Example: 1) $-6 < -4$ 2) 8 + 6 > 6 + 4   3) $2 \times 3 < 4 \times 5$

5) Inequality sign always pointed towards the lesser number.

6) x > 0 means x is a positive number.

7) x < 0 means x is a negative number.

8) Some times two or more inequalities are written in one sentence.

Example: 3 < 5 < 8 means 3 < 5 and 5 < 8 or 5 lies between 3 and 8.

Inequation: An open sentence containing one of the signs $\neq$, <, $\leq$, > or $\geq$ is called inequations.   or

A relationship between two algebraic expressions which are not equal and written   by symbols $\neq$, <, > , $\leq$, or $\geq$ is called an inequation.

Example: 1) x + 2 > 5   2) x + 3 $\geq$ 13.5   3) 2x + 1 > 9

Linear inequation in one variable: An inequation which involves only one variable is called 'linear inequation in one variable' or 'simple inequation'.

General forms of an Inequation : A statement of any of the forms

1) ax + b > 0   2) ax + b < 0   3) ax + b $\geq$ 0   4) ax+ b < 0

Where a and b are real numbers and $a \neq 0$.

Roots of the inequation: The replacement numbers which make the inequation statement true are called roots of the inequation. An inequation may have a single root, more than one root or no root at all.

Domain of the variable or replacement set: The set from which the values of the   variable x are replaced in an inequation, is called the domain of the variable or the replacement set.

Properties of Inequations:

1) Adding the same number to each side of an inequation does not change the inequality

Example: x + 2 < 5 $\Rightarrow$ x + 2 + 3 < 5 + 3

2) Substracting the same number from each side of an inequation doesnot change the inequality.

Example: 3x + 4 < 9 $\Rightarrow$ 3x + 4 – 2 < 9 – 2

3) Multiplying each side of an inequation by the same positive number doesnot change the inequality

Example: $\dfrac{x}{6} < 3 \Rightarrow \dfrac{x}{6} \times 6 < 3 \times 6$

4) Multiplying each side of an inequation by the same negative number, reverses the inequality

Example: $\dfrac{x}{5} < 10 \Rightarrow \dfrac{x}{5} \times (-5) > 10 \times (-5)$

5) Dividing each side of an inequation by the same positive number doesnot change the inequality

Example: $x + 4 < 9 \Rightarrow \dfrac{x+4}{3} < \dfrac{9}{3}$

6) Dividing each side of an inequation by the same negative number, reverses the   inequality

Example: $x + 2 < 4 \Rightarrow \dfrac{x+2}{-2} > \dfrac{4}{-2}$

WORK SHEET - 1

SINGLE ANSWER TYPE

1. The solution set of x < 5, where x $\in$ N is ____

   1) { 0,1,2,3 }   2) { 1,2,3,4 }   3) { 2,3,4 }   4) { 0,1,2,3,4 }

2. The root of inequation x + 2 $\leq$ 3, where x $\in$ N is ____

   1) 4   2) 3   3) 2   4) 1

3. The solution set of 3x + 4 < 15, x $\in$ N is ____

   1) { 2,3,4 }   2) { 3,4,5 }   3) { 4,5,6 }   4) { 1,2,3 }

4. The solution set of 1 - 3x < -4, x $\in$ N is _____

   1) { 1,2 }   2) { 1 }   3) { 1,2,3 }   4) { 2,3,------ }

5. If 2x < 12 an inequation, then the number of solutions if x $\in$ N is ___

   1) 2   2) 4   3) 5   4) 6

6. The domain of the inequation 6x-7 $\geq$ 29 where x $\in$ N is ___

   1) {6,7,8,......}   2) {3,4,5,....}   3){0,1,2,3,4,5}   4) {0,1,2,3}

7. If 7x >18 + x, then the value of x is greater than _____

   1) 4   2) 5   3) 7   4) 3

8. If A = { -3,-2,-1,0,1,2,3} then the solution for x of 2x - 1< 4 in A is

   1) { -3,-2,-1,0,1,2,3 }   2) { -3,-2,-1,0,1,2 }

   3) { 0,1,2,3 }   4) { -3,-2,-1}

9. The domain of 2(3x - 1)<5, x $\in$ N is _____

   1) { 1}   2) 1   3) (0, 1)   4) (0, 2)

10. In an inequality the vertex of a inequality symbol is always lies towards ___ quantity.

    1)smaller   2) greater   3)equal   4) 1 and 3

11. If 5 < x-2,then ___

    1) x < 7   2) x > 7   3) x < $\dfrac{5}{2}$ 4) x > $\dfrac{5}{2}$

12. If 5 + { 2x + (4x - 2)- 2 } = 0, then x is

1) $\dfrac{-1}{2}$ 2) $\dfrac{-1}{6}$ 3) $\dfrac{1}{6}$ 4) $\dfrac{1}{2}$

13. If (x+2)(x-2)=(x+3)(x-5)+12,then x is

1) $\dfrac{1}{2}$ 2) $\dfrac{3}{2}$ 3) $\dfrac{2}{3}$ 4) $\dfrac{1}{4}$

14. Any term of an equation may be taken to the other side with
     the sign changed.This process is called
     1) transposition   2) domain   3) variable   4) root

15. If $\dfrac{x+1}{x-1} = \dfrac{3}{5}$,then x is

1) 2   2) -6   3) -4   4) 5

16. If (x + 5) + (2x+5) = 70,then x is _____
     1) 20   2) 25   3) 30   4) 35

17. If 0.2x-3.2 = 0.7x-3.7, then x is
     1)0.2   2)1.2   3)1.0   4) 1.23

18. If $\dfrac{3}{5}(x+3) - \dfrac{1}{5}(2x-4)$ = 3,then x is _____

1) 2   2) 3   3) 5   4) 6

19. The domain of the equation $\dfrac{2x+4}{4} \geq -5$ is

1) $x \leq -14$ 2) $x \leq -13$ 3) $x \geq -12$ 4) $x \leq 20$

20. If $25a^2 + (20+m)ab + 16b^2$ is a perfect square then the value of m is ---

1) 20   2) 4   3) 10   4) 5

21. If $\dfrac{x-2}{3} + \left[\dfrac{2x-1}{3} - \left(\dfrac{1-2x}{2} + 5\right)\right] = \dfrac{x-2}{6}$, then x is

1) $\dfrac{12}{7}$ 2) $\dfrac{37}{11}$ 3) $\dfrac{35}{12}$ 4) $\dfrac{16}{19}$

22. If the angles of a triangle are 2x+20,x and 3x-20 then the
     largest angle is _____ degrees.
     1) 70°   2) 80°   3) 90°   4) 75°

MULTI ANSWER TYPE

23. Which of the following statements are true ?

    1) If a > b, then a + c > b + c   2) If a > b, then a - c < b - c

    3) If a > b and c > 0, then ac > bc   4) If a > b and c < 0, then ac > bc

24. Which of the following statements are not false ?

    1) A statements of ineuality between two expressions involving a
       single variable ' x' with highest power 1 is called a linear inequation.

    2) If reciprocals are taken to quantities of the same sign on both
       sides of an inequality, then the order of the inequality is changed.

    3) In number line the greater number always lies to the right of the
       lesser one.

    4) In number line the smaller number always lies to the left of the
       greater one.

25. If two sides of an equilateral triangle are 5x+1 and 4x+3 units,then

    1) x = 2 units   2) x = 3 units

    3)third side is 11 units   4) third side is 15 units

26. If 3x + 4 <15, $x \in N$ then the solution set is

    1) {1,2,3 }   2) {x:x$\in$N,x$\leq$3}   3) {x:x$\in$N,x$\geq$3}   4) {1,2}

REASONING ANSWER TYPE

27. Statement I: Consider -3,5 and 7 If -3 < 5, 5 < 7 then -3 < 7

    Statement II: If in three numbers, the first is less than the second and the
    second is less than the third,then the first is less than the third.

    1)   Both Statement-I and Statement-II are true.

    2)   Both Statement-I and Statement-II are false.

    3)   Statement I is true, Statement II is false.

    4)   Statement I is false, Statement II is true.

28. Statement I: If the inequality 21 > 15, dividing each side by -3 then the
    inequality is -7 < -5

    Statement II: Dividing each side of an inequality by a negative number,
    reverses the inequality.

    1)   Both Statement-I and Statement-II are true.

    2)   Both Statement-I and Statement-II are false.

    3)   Statement I is true, Statement II is false.

    4)   Statement I is false, Statement II is true.

29. Statement I: If 5y + 3 = 2y + 6,then y is 1.

    StatementII:Changing a term from one side of an equation to the other side
    is called transposition.

    1)   Both Statement-I and Statement-II are true.

    2)   Both Statement-I and Statement-II are false.

    3)   Statement I is true, Statement II is false.

    4)   Statement I is false, Statement II is true.

30. Statement I:If $(5.5)^2 - (4.5)^2$ is 10

    Statement II: $a^2 - b^2 = (a+b)(a-b)$

    1) Both Statement-I and Statement-II are true.
    2) Both Statement-I and Statement-II are false.
    3) Statement I is true, Statement II is false.
    4) Statement I is false, Statement II is true.

COMPREHENSION TYPE

Writeup:1

Dividing each side of an inequality by a positive number, does not change the inequality.

Dividing each side of an inequality by a negative number, reverses the inequality.

31. If a > b and c<0 then

    1) $\dfrac{a}{c} > \dfrac{b}{c}$ 2) $\dfrac{a}{c} \geq \dfrac{b}{c}$ 3) $\dfrac{a}{c} < \dfrac{b}{c}$ 4) $\dfrac{a}{c} \leq \dfrac{b}{c}$

32. If a < b and c > 0 then

    1) $\dfrac{a}{c} > \dfrac{b}{c}$ 2) $\dfrac{a}{c} \geq \dfrac{b}{c}$ 3) $\dfrac{a}{c} < \dfrac{b}{c}$ 4) $\dfrac{a}{c} \leq \dfrac{b}{c}$

33. If a > b and c > 0 then

    1) $\dfrac{a}{c} > \dfrac{b}{c}$ 2) $\dfrac{a}{c} \geq \dfrac{b}{c}$ 3) $\dfrac{a}{c} < \dfrac{b}{c}$ 4) $\dfrac{a}{c} \leq \dfrac{b}{c}$

Writeup:2

The replacement set of the varible of an equation is called the domain of the varible.

34. If $\dfrac{3x}{5} + 2 \leq 17$ domain of the inequation is

    1) $x > 25$ 2) $x \geq 25$ 3) $x \geq 25$ 4) $x \leq 25$

35. The domain of the inequation $\dfrac{2x+4}{4} \geq -5$ is

    1) $x \leq -13$ 2) $x \leq -14$ 3) $x \geq -12$ 4) x=12

36. The domain of the inequation $\dfrac{6(x+2)}{2} \geq 8$ is

    1) x=1   2) $x \geq \dfrac{2}{3}$ 3) $x \geq 0$ 4) $x \leq 0$

Writeup:3

One number is 5 less than the other and their sum is 25, then

37. The smallest number is
    1) 5   2) 10   3) 15   4) 12
38. The greatest number is
    1) 10   2) 20   3) 5   4) 15
39. The product of the numbers is
    1) 150   2) 156   3) 100   4) 126

Writeup:4

The cost of 17 pens and 29 pencils is Rs 217, while the cost of 29 pens and 17 pencils is Rs 289

40. cost of a pen is
    1) Rs 10   2) Rs 8.50   3) Rs 2.50   4) Rs 8
41. cost of a pencil is
    1) Rs 4.50   2) Rs 2   3) Rs 3.50   4) Rs 2.50

42. Let the cost of pen is x and pencil is y then 2x + 3y is
    1) Rs 24.50   2) Rs 25   3) Rs 25.50   4) Rs 24

MATRIX MATCHING TYPE

43. **Column-I**   **Column-II**
    a) If a > b and c > 0, then   1) ab < bc
    b) If a < b and c > o, then   2) ab > bc
    c) If a > b and c < 0, then   3) ac < bc
    d) If a < b and c < 0, then   4) ac > bc
                                                          5) ac $\leq$ bc

44. **Column-I**   **Column-II**
    a) $\{x : x \leq 1, x \in I\}$ 1) { -3,-2,-1,0,1 }
    b) $\{x : x > 0, x \leq 2, x \in I\}$ 2) { 1,2,3,4 }
    c) $\{x : x \geq 1, x \in Q\}$ 3) { 0,1,2 }
    d) $\{x : x \leq 1, x \in Q\}$ 4) { -3,-2,-1,0,1,2 }
                                                          5) { 1,2,3,4,5 }

45. **Column-I**   **Column-II**

    a) If $2\left(x - \dfrac{1}{2}\right) + 2 = 0$, then x is   1) $\dfrac{4}{5}$

    b) If $\dfrac{x}{2} - \dfrac{1}{2} = x + \dfrac{1}{3}$, then x is   2) 12

    c) If $\dfrac{1}{x} + \dfrac{3}{x} = 5$, then x is   3) $-\dfrac{1}{2}$

d) If $\dfrac{2x}{3} - \dfrac{x}{2} = 2$, then x is   4) $-\dfrac{5}{3}$

5) 1

46. **Column-I**   **Column-II**

a) If 0.3(x - 0.6) = x-1.16 then x is   1) 100

b) If $0.5x - 2.5 = 77.5 - 0.3x$ then x is   2) 51/7

c) If $-\dfrac{17}{3} + \dfrac{7x}{6} = \dfrac{x}{2} - \dfrac{x}{9}$ then x is   3) symmetry

d) By which property 24=8x can b
   written as 8x=24   4) reflex

5) 7/5

INTEGER ANSWER TYPE

47. If x $\in$ N, then the number of solutions of inequation 7x + 3 $\leq$ 17 is _____

48. If $x \in$ N, then the root of the equation 4x-3=21 is _____

WORK SHEET - 2

SINGLE ANSWER TYPE

1. The variable in the equation 6x+2=5 is
    1) 6   2) x   3) 2   4) 6x

2. If 'm' is a natural number and m(m+1)=30 then 'm' is equal to
    1) 5   2) 6   3) -5   4) -6

3. Write L.H.S and R.H.S of 2x+y=2(x+y)
    1) 2x+y   2) 2(x+y)   3) x+y   4) both 1 and 2

4. If $\dfrac{ax+b}{cx+d} = \dfrac{m}{n}$ then n(ax+b) =

    1) (cx+d)   2) m(c+d)   3) m(cx-d)   4) m(cx+d)

5. If 5x-17=2x-8   then x =
    1) -3   2) 3   3) $6 \div 2$ 4) both (2) and (3)

6. If $p - 1\dfrac{1}{2} = 2\dfrac{1}{2}$ then the value of $p^2 + p$ is_____.

    1) 4   2) 16   3) 20   4) 8X5

7. A number increased by '9' gives 43 then number is
    1) 43   2) 34   3) 52   4) 25

8. The value which the variable takes 3(x-1)$\leq$ 2(x+3) in { 8, 9,10, 11} is
    1) x=8   2) x=10   3) x=9   4) both (1) and (3)

9. The value which the variable takes $\dfrac{3x-5}{2} \geq 4$ in { 5, 6, 7 } is

   1) x=5   2) x=6   3) x=7   4) All of the above

10. A number exceeds four-sevenths by 18. Then the number is
    1) 24   2) 42   3) 18   4) 72

11. The length of a rectangular park is seven times to it's breadth. If the perimeter of the park is 256 m, then the dimensions are
    1) 112 m   2) 16 m   3) 16 cm   4) both (1) and (2)

MULTI ANSWER TYPE

12. If x+5=20 then x is

    1) 25   2) 15   3) $\dfrac{30}{2}$ 4) 5×5

13. which of the following are linear equations.

    1) x+y =11   2) m^3 =64   3) x+y+z = 100   4) p+12 =15

14. A man purchased some pens at Rs 8 each and some pencils at Rs.2.50 each. If the total number of pens and pencils purchased is 27 and their total cost is Rs. 150, how many pencils did he buy?

    1) 15   2) $\sqrt{225}$ 3) 25   4) $\sqrt{625}$

REASONING ANSWER TYPE

15. *Statement I: The equation x+3=3 then x=0*
    Statement II: The root of an equation is in 'N'
    1) Both Statement-I and Statement-II are true.
    2) Both Statement-I and Statement-II are false.
    3) Statement I is true, Statement II is false.
    4) Statement I is false, Statement II is true.

16. *Statement I: Two complementary angles differ by* $8°$ *. Then the angles are* $41°$ *and*

    $49°$

    Statement II: A number exceeds 20% of itself by 40. The number is 50
    1) Both Statement-I and Statement-II are true.
    2) Both Statement-I and Statement-II are false.
    3) Statement I is true, Statement II is false.
    4) Statement I is false, Statement II is true.

COMPREHENSION TYPE
Writeup:1

Equations are (1) 2y+1=11   (2) $\dfrac{p}{2}$ =18   (3) 5x=0 then

17. The value of y in equation (1) is
    1)-5   2) 11   3) 5   4) 4

18.   The root of equation (2) is
      1) 18   2) 18X2   3) 18+2   4) 18-2
19.   The root of equation (3) is
      1) 0   2) 5   3) -5   4) Undefined

Writeup:2
      Two equal sides of a triangle are each 5m less than twice the third side. If the perimeter of the triangle is 55m. Then
20.   The length of the third side is
      1) 13 m   2) 21 m   3) 12 cm   4) 10 cm
21.   The length of equal side is
      1) 13 m   2) 31 cm   3) 21 m   4) 12 m
22.   If each side is doubled then the perimeter is
      1) 110 m   2) 100 m   3) 120 m   4) 90 m

MATRIX MATCHING TYPE
23.   Column-I   Column-II
      a) If 3y+4=8y-1, then y =   1) 1

      b) If $\dfrac{3}{x} = 1\dfrac{1}{2}$, then x =   2) 8

      c) If $\dfrac{t}{2} = 8\dfrac{1}{2}$, then t =   3) 17

      d) If $\dfrac{1}{2}$x = 4 , then x =   4) 2

                                                          5) -17

INTEGER ANSWER TYPE
24.   The R.H.S part of 12-y=25 is _____

KEY & HINTS

WORK SHEET – 1 (KEY)

1) 2	2) 4	3) 4	4) 4	5) 3
6) 1	7) 4	8) 2	9) 1	10) 1
11) 2	12) 2	13) 1	14) 1	15) 3
16) 1	17) 3	18) 1	19) 3	20) 1
21) 2	22) 2	23) 1,2,3	24) 1,2,3,4	25) 1,3
26) 1,2	27) 1	28) 1	29) 1	30) 1
31) 3	32) 3	33) 1	34) 4	35) 3
36) 2	37) 2	38) 4	39) 1	40) 2
41) 4	42) 1	43) 4,3,3,4	44) 1,3,2,1	45) 3,4,1,2
46) 5,1,2,3	47) 2	48) 6		

WORK SHEET – 2 (KEY)

1) 2	2) 1	3) 1	4) 4	5) 4
6) 3	7) 2	8) 1	9) 4	10) 2
11) 2	12) 2,3	13) 1,3,4	14) 1	15) 3
16) 1	17) 3	18) 2	19) 1	20) 1
21) 3	22) 1	23) 1,4,3,2	24) 25	

1)   conceptual

2)   if m=5 then 5(5+1)=30 $\Rightarrow$ 5X6=30 $\Rightarrow$ 30=30

3)   conceptual

4)   n(ax+b)=m(cx+d)

5)   5x-2x=-8+17   3x=9   x=3

6)   p-$\dfrac{3}{2}$=$\dfrac{5}{2}$ p=$\dfrac{5}{2}$+$\dfrac{3}{2}$=$\dfrac{8}{2}$=4 $\therefore p^2 + p = 16 + 4 = 20$

7)   The number is x.it is increased by 9 is x+9 the result is 43

      $\therefore$ x+9=43   x=34

8) if x=8   3x7$\leq$2x11   21$\leq$22(true)

      if x=9   3x8$\leq$2x12   24$\leq$24(true)

      if x=10 3x9$\leq$2x13 27$\leq$26(false)

      if x=11 3x10$\leq$2x14 30$\leq$28(false)

9)   if x=5 $\dfrac{15-5}{2} \geq 4$ 5$\geq$4(true) similarly verify other values

10. x=$\dfrac{4x}{7}$+18 $x - \dfrac{4x}{7} = 18$ $\dfrac{3x}{7} = 18$ x=42

11. breadth=x length=7x 2(l+b)=256 l+b=128 8x=128 x=16

12) X+5=20 X=20-5   x=15

13) conceptual

14. no.of pens bought=x no of pencils bought= 27-x

      8x+(27-x)$\dfrac{5}{2}$=150 x=15

15) x+3=3   X=3-3   X=0 S:(1) is true

      clearly,'0' is not in the set of natural numbers   S:(2) is false

16)   s : (1) the required angles are $x°,(90-x)°$ since sum of complementary

      angles=$90°$;   x-(90-x)=8 $\Rightarrow$ x-90+x=8 $\Rightarrow$ x=49

      s : (2) let the number=x   20% of itself=$\dfrac{20}{100}$ $Xx = \dfrac{x}{5}$

$\therefore x = \dfrac{x}{5} + 40 \qquad x - \dfrac{x}{5} = 40 \qquad \therefore$ x=50

17) 2y+1=11 $\Rightarrow$ 2y=10 $\Rightarrow$ y=5

18) P/2=18 P=2X18

19) X=0/5=0

21) let third side=x two sides are (2x-5),(2x-5) perimeter=2x-5+2x-5+x=5x-10=55, 5x=65, x=13 sides are 13m,21m,21m

23) a) 3Y-8Y=-1-4   -5Y=-5 Y=1   b) $\dfrac{3}{x} = \dfrac{3}{2}$ $\therefore$ x=2

c) $\dfrac{t}{2} = \dfrac{17}{2}$ $\therefore$ t=17   d) $\dfrac{1}{2}$ x=4 x=8

24) conceptual